



FOREST PEST MANAGEMENT

Pacific Southwest Region

Report No. 81-27

3430 Evaluation
September 14, 1981

A BIOLOGICAL EVALUATION OF THE BLUFF
CREEK AREA, ORLEANS RANGER DISTRICT,
SIX RIVERS NATIONAL FOREST

PSW FOREST AND RANGE
EXPERIMENT STATION

SEP 29 1981

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ABSTRACT

The Bluff Creek area on the Orleans Ranger District was evaluated to develop pest management alternatives which should be considered in the planned salvage of Douglas-fir mortality in the area. The major disease problem present which will affect future management is black stain root disease. Management alternatives for reducing the impact of this disease are presented. Decay and heart rot fungi, including Phaeolus schweinitzii, Phellinus pini, Fomitopsis cajanderi and Fomitopsis pinicola, were prevalent. Only a minor amount of Douglas-fir beetle activity was noted.

INTRODUCTION

In response to a request from Tom Bouse, Assistant Silviculturist, Orleans Ranger District, the proposed Bluff Creek Salvage Sale and surrounding stand was examined on August 18, 1981. The objectives of the evaluation were to determine if insect and/or disease problems which could affect management objectives were associated with mortality of Douglas-fir trees and, specifically, to confirm the suspected presence of a root disease and its affect on Douglas-fir regeneration if the area were to be clearcut and planted.

OBSERVATIONS

The area examined in Bluff Creek is a 20 to 80% stocked, 100-110-year-old stand of sawtimber-size Douglas-fir. Tanoak, myrtle, incense-cedar and ponderosa pine trees are intermixed with the Douglas-fir. The most prevalent ground cover is sword fern. Terrain is 30 to 70% slope with an east aspect. Soils are mostly serpentine intermixed with Hugo.

An approximately 3-acre site just above the Bluff Creek Road consists of dead and dying Douglas-fir, with the oldest dead trees near the center and trees with thin, fading crowns near the margin. The fading trees at this site are marked for salvage. Four additional groups or centers of dead and dying Douglas-fir trees are present farther up slope. No recently dead trees - those that have died within the last year - were observed. Smaller Douglas-fir trees, 10 to 15 inches dbh, within these pockets appeared vigorous and healthy. Numerous Douglas-fir trees are on the ground throughout the hillside stand, presumably as a result of the 1964 flood and associated high winds. Salvage of on-going Douglas-fir mortality in the area has occurred periodically.

Portions of the root systems of five fading and three dead Douglas-firs were excavated and examined. One recently dead Douglas-fir seedling adjacent to a skid row was also examined. The roots from the living, fading trees were heavily soaked with resin. Black stain root disease was found on the smaller roots of one fading tree on the three-acre site and on the seedling. Mycelial fans of Armillariella mellea were also present on the seedling. Black stain root disease was not found at or near the mortality centers up slope. However, Douglas-fir trees in these areas had crown symptoms suggestive of a root disease, and only a small sample of roots from the fading trees could be examined. Recently dead trees, in which the stain typical of the disease would be evident, were not present.

Conks of the velvet top fungus, Phaeolus (Polyporus) schweinitzii, were found on the ground in the lower 3-acre site. Stems of almost all the overstory Douglas-firs within and near the mortality centers had numerous conks of Phellinus (Fomes) pini associated with branch stubs. Fomitopsis cajanderi (Fomes subroseus) was also fairly common on trees. Fomitopsis (Fomes) pinicola was common on logs on the ground.

Adults of the Douglas-fir beetle, Dendroctonus pseudotsugae, were found on two recently killed (but not yet faded), Douglas-fir trees that had apparently healthy crowns. Although numerous windthrown trees were present in the vicinity, no other dead or dying Douglas-fir trees were observed nearby.

BIOLOGY OF PEST ORGANISMS

BLACK STAIN ROOT DISEASE

Black stain root disease, caused by the fungus Ceratocystis wagneri (Verticicladiella wagnerii), causes a vascular wilt of numerous conifer species. The disease affects Douglas-fir, ponderosa, Jeffrey, lodgepole and pinyon pines, and occasionally western hemlock. Sugar pine and western

white pine are rare hosts. True firs, incense-cedar, redwood and giant sequoia are resistant. There are different strains of the fungus that appear to be relatively host specific. The strain from Douglas-fir occurs only on Douglas-fir; even where Douglas-fir is mixed with pines, the fungus does not cross over to infect the other species.

The fungus infects the roots, then spreads throughout the sapwood of the root system, root crown, and lower bole. This infection of the roots causes a visible decline in the tree crown. Terminal growth is reduced, needles become shortened and chlorotic, the number of needles produced and retained is reduced, and finally the host dies. Infection is characterized by a distinctive black to dark chocolate brown stain that occurs in the sapwood of the roots, root crown, and lower bole. The stained sapwood is often infiltrated with resin. There are instances where the fungus may not be in the stems of Douglas-fir and closer examination of the roots is necessary to diagnose the disease. Because the fungus is confined to the tracheids and does not move through ray parenchyma, the stain tends to occur in arcs that follow the annual rings rather than in the wedge-shaped patterns characteristic of other sapwood stains. The fungus does not decay the wood and does not produce macroscopic fruiting bodies.

Spread of C. wagneri into new areas and the initiation of new infection centers appears to be by insect transmission. Beetles, most likely scolytids (bark and engraver beetles) and curculionids (weevils), find stressed and low-vigor trees suitable for breeding, and could carry the spores of the fungus if they come from infected trees. When feeding on the root system, they introduce the spores into the vascular system of the tree. The fungus moves up the roots to the root crown and then spreads around the tree to other roots. Douglas-fir can be killed within 2 to 4 years. Local spread within an infection center is through root contacts or by the fungus moving short distances (up to 15 cm) through the soil. Even though the fungus spreads through the root systems of living trees, it rarely spreads, or even survives, in roots after the infected tree dies.

VELVET TOP FUNGUS

The velvet top fungus, Phaeolus (Polyporus) schweinitzii, causes a root and butt rot of conifers and is most common on Douglas-fir along the Pacific Coast. Although it has been reported as a trunk rot, it almost always is confined to the root system and lower 8 to 10 feet of the tree bole. Extensive decay of the roots of older trees often leads to windthrow. Infection occurs through small roots and through basal wounds. Trees infected with P. schweinitzii seldom have crown symptoms which would indicate that this root disease is present.

The annual conks are found associated with old wounds on the butts of infected trees or more often are found on the ground nearby, coming up from decayed roots. Conks indicate extensive decay in the tree butt. Timber losses are not precisely known but are considered high, both because the valuable butt logs are badly decayed and because infected trees are pre-disposed to windthrow. Control strategies include reducing the number of stand entries and avoiding damage to residual trees to minimize decay hazards.

HEART ROT FUNGI

Heart rot fungi, those that attack and decay the nonliving heartwood, render timber unmerchantable, reduce the quality of wood that is used, and predispose trees to windthrow and breakage. Generally, heart rot fungi do not penetrate sound trees, but require an opening into the heartwood through which to invade. Openings would include wounds made by fire, weather, and human activities, and natural openings such as branch stubs and dead branches. Reducing injuries to residual trees during thinning or partial cuts will help reduce the impact of most heart rot fungi.

The red ring rot fungus, Phellinus pini, infects trees through living and dead branches or branch stubs. Open wounds rarely become infected. Mostly heartwood is affected, but sapwood can also be invaded. In general, the presence of a conk indicates decay 8 feet above and 8 feet below the conk. Fomitopsis cajanderi, recognized by the pinkish rose-colored lower pore surface on the bracket-like conks, acts much the same way as P. pini. Fomitopsis pinicola, another common wood rot of Douglas-fir, is mainly a decomposer of dead and down timber, but can cause heart rot in living trees. The fungus enters the tree mainly through wounds and broken or dead tops.

DOUGLAS-FIR BEETLE

The Douglas-fir beetle, Dendroctonus pseudotsugae, attacks Douglas-fir throughout the host's range. Normally it breeds in felled, injured, or diseased trees. In coastal northern California, outbreaks are sporadic and of short duration, usually developing after extensive windthrow or large fires. Reddish or yellowish boring dust in bark crevices or around the base of trees is the usual evidence of attack. No pitch tube is formed, but resin may exude from attacks on the upper bole. The beetle has one generation per year. Adults and large larvae overwinter, with adults predominating. The adults emerge and attack trees from April to June. Some of these adults reemerge and attack additional trees, establishing a second brood. Adults that develop from the overwintering large larvae emerge and attack in July and August.

Host resistance generally keeps populations of the Douglas-fir beetle in check. Even when outbreaks occur following stand disturbance, they abruptly subside because the beetles do not thrive in healthy standing green timber. Trees less than about 100 years old are seldom infested in undisturbed forests. Direct control is seldom attempted. In the coastal region, prompt salvage of beetle-killed, windthrown, and fire-killed trees before the beetles emerge is the only practical course of action.

MANAGEMENT OPTIONS

Douglas-fir in the Bluff Creek area have extensive windthrow and a prevalence of heart rot; black stain root disease is present in at least one site. Management options are limited by the designation of the stand as a

high visual area. The pest organism most likely to affect future management of the stand is C. wagneri. Additional sampling of Douglas-fir roots from fading and recently dead trees in the other mortality centers would better define the extent of the pathogen in the Bluff Creek area.

The following options apply specifically to black stain root disease considerations in the lower 3-acre site.

1. No Action: Black stain root disease will continue to spread through root contacts, resulting in growth reduction and continued mortality of Douglas-fir. The rate of spread will depend on how continuous the system of Douglas-fir roots is, and will be slowed by roots of resistant or nonhost species which will interfere with the continuum. As the disease progresses, an inadequately stocked stand will result.

2. Salvage dead and dying trees: This option will remove dead and dying trees and realize some economic value from the timber. However, salvage alone will not mitigate the effects of black stain root disease and the pathogen will likely continue to spread to adjacent Douglas-firs.

3. Salvage dead and dying trees, create a 75 ft. buffer strip: The creation of a 75-foot buffer strip around the margin of the infection center would theoretically stop the spread of black stain root disease to adjacent uninfected Douglas-firs. The fungus requires live host tissue to survive, and dead host roots in the buffer strip will not support the pathogen. Because the fungus is host specific, a nonhost species (incense-cedar) or the resistant species (ponderosa pine) can be favored and planted. Douglas-fir could be re-established after a few years, at which time the fungus will have died out.